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(54) LIGHT-EMITTING PANEL DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a large and uniform surface light-emission by providing at least one light-emitting part having a rod-like light source disposed along a light-incoming surface.

SOLUTION: In a light-emitting part 10, a fluorescent tube 12 as rod-like illuminant is disposed along a light-incoming surface 11a of a light-guiding plate 11. Part of light emitted from the fluorescent tube 12 directly comes in the light-incoming surface 11a and the rest is irregularly reflected by a lamp reflector 13 and comes in the light-incoming surface 11a. Light introduced from the light-incoming surface 11a is irregularly reflected by a light reflector 14, passes through the interior of the light-guiding plate 11, and is emitted from a light-reflecting surface 11b. Or, the light is furthermore irregularly reflected by light reflectors 15, 16 and emitted from the light-reflecting surface 11b. Light introduced from the light-emitting surface 11b into

a light-diffusing plate 17 is diffused in the forward direction by a light-diffusing function of the light- diffusing plate 17 and emitted in the direction shown by an arrow 30 as light uniformed in the direction of the surface.

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CLAIMS

[Claim(s)]
[Claim 1] The light guide plate equipped with the side face of the pair which is a rectangle-like as a whole and has been arranged face to face, and the optical plane of incidence and the luminous-radiation side which have been arranged face to face, and said side face which countered It is luminescence panel equipment characterized by having at least one light-emitting part with the cylindrical light source which it inclines in the same direction, and said optical plane of incidence is arranged along said side-face acute-angle side base, and has been arranged along with this optical plane of incidence.

[Claim 2] It is luminescence panel equipment characterized by for said light-emitting part being plurality, and each light-emitting part aligning so that it may be arranged on said side face of the side which said each cylindrical light source leaves mutually in claim 1.

[Claim 3] Said each light-emitting part is luminescence panel equipment characterized by being arranged two-dimensional so that said each cylindrical light source may be alternately arranged in claim 2.

[Claim 4] The 1st light reflex plate which reflects the light which said each light-emitting part has been arranged on said side face by the side of said cylindrical light source of said light guide plate, respectively, and was introduced into said light guide plate from said optical plane of incidence in claim 1, and the interior of said light guide plate is made to carry out a light guide, Luminescence panel equipment characterized by having the 2nd light reflex plate which reflects the light which has been arranged on said cylindrical light source of said light guide plate, and said side face of the left side, and has penetrated the interior of said light guide plate in said luminous-radiation side.

[Claim 5] Said each light-emitting part is luminescence panel equipment characterized by having the 3rd light reflex plate which reflects in said luminous-radiation side the light which has been arranged at said cylindrical light source of the field where said optical plane of incidence of said light guide plate has been arranged in claim 1, and the part which has not countered, and has penetrated the interior of said light guide plate, respectively.

[Claim 6] It is luminescence panel equipment characterized by having the reflector which reflects in said optical plane of incidence of said light guide plate the light which has been arranged as covered said cylindrical light source, and was emitted from said cylindrical light source while an edge pastes up said each light-emitting part on the periphery of said optical plane of incidence of said light guide plate in claim 1, respectively.

[Claim 7] Luminescence panel equipment characterized by having the optical diffusion sheet which diffuses the light which has been arranged in claim 2 as covered said luminous-radiation side of two or more of said light guide plates, and was emitted from said luminous-radiation side.

[Claim 8] It is luminescence panel equipment characterized by being arranged so that it may have the nonluminescent field where said each cylindrical light source is formed in the both sides of a luminescence field and this luminescence field in claim 1 and the nonluminescent field of a parenthesis may project from said optical plane of incidence of said light guide plate.

[Claim 9] It is luminescence panel equipment characterized by being arranged so that said each cylindrical light source may have a luminescence field and the nonluminescent field formed in the both sides of this luminescence field, and said one

[at least] nonluminescent field may be bent by the one direction in claim 1, it may be formed and only said luminescence field may counter with said optical plane of incidence of said light guide plate.

[Claim 10] It is luminescence panel equipment characterized by being arranged so that said nonluminescent field where said each cylindrical light source was bent in claim 9 may approach the field where said optical plane of incidence of each of said light guide plate has been arranged.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the luminescence panel equipment which a light guide plate is made to penetrate the light emitted from the cylindrical light source, and obtains field luminescence.

[0002]

[Description of the Prior Art] This kind of luminescence panel equipment is widely used as a back light of a liquid crystal display panel. In addition, luminescence panel equipment is used as a back light of the information board used in order to provide a user with various kinds of information at a store, a station, etc. Drawing 4 is the block diagram of conventional luminescence panel equipment, and drawing 4 (A) is [a top view and drawing 4 (C) of a perspective view and drawing 4 (B)] the sectional views of the 4C-4C' line of drawing 4 (B).

[0003] In drawing 4 , a light guide plate 111 makes the light introduced from optical plane-of-incidence 111a penetrate, and is emitted from luminous-radiation side 111b. In this light guide plate 111, two light plane-of-incidence 111a counters, and is arranged, this two light plane-of-incidence 111a is adjoined, and one luminous-radiation side 111b is arranged. As shown in drawing 4 (C), two fluorescence tubing 112 counters each optical plane-of-incidence 111a of a light guide plate 111, respectively, and is arranged. Each fluorescence tubing 112 is covered by the lamp reflector 113 except for the optical plane-of-incidence 111a side of a light guide plate 111, respectively. The edge of each lamp reflector 113 is pasted up on the periphery of each optical plane-of-incidence 111a of a light guide plate 111, respectively. Moreover, adhesion arrangement of the optical diffusion plate 117 is carried out at luminous-radiation side 111b of a light guide plate 111, and adhesion arrangement of the light reflex plate 115 is carried out in luminous-radiation side 111b and the field which counters. In addition, in drawing 4 (B), the longer direction of the fluorescence tubing 112 is made into the longer direction of a light guide plate 111, and a direction

perpendicular to this is made into the shorter direction of a light guide plate 111.

[0004] As for the light emitted from each fluorescence tubing 112, direct incidence of the part is carried out to optical plane-of-incidence 111a of a light guide plate 111, it is reflected by the lamp reflector 113 and incidence of the remainder is carried out to optical plane-of-incidence 111a of a light guide plate 111. While the light introduced from optical plane-of-incidence 111a penetrates the interior of a light guide plate 111, scattered reflection of it is carried out by the reflecting plate 115. Optical diffusion is carried out by the optical diffusion function of the optical diffusion plate 117 in the direction of a front face, and the light introduced into the optical diffusion plate 117 from luminous-radiation side 111b of a light guide plate 111 is emitted in the direction shown in drawing 4 (C) by the arrow head 130 as a light uniform in the direction of a field. In addition, the luminescence panel equipment shown in drawing 4 is indicated by JP,2-160215,A etc.

[0005]

[Problem(s) to be Solved by the Invention] In recent years, the request to enlargement of the luminescence panel equipment used as a back light of this display is becoming strong with enlargement of a display. However, if the shorter lay length of a light guide plate 111 exceeded a predetermined value, since the light by which a light guide is carried out to the field distant from optical plane-of-incidence 111a would become weak with the conventional luminescence panel equipment shown in drawing 4 , the light emitted from luminous-radiation side 111b became an ununiformity, and there was a problem that brightness spots occurred.

[0006] It is made in order that this invention may solve such a technical problem, and the purpose is in offering the luminescence panel equipment which can obtain uniform large and field luminescence.

[0007]

[Means for Solving the Problem] In order to attain such a purpose, this invention The light guide plate equipped with the side face of the pair which is a rectangle-like as a whole and has been arranged face to face, and the optical plane of incidence and the luminous-radiation side which have been arranged face to face, The side face which countered inclines in the same direction, and optical plane of incidence is arranged along the side-face acute-angle side base, and is equipped with at least one light-emitting part with the cylindrical light source arranged along with this optical plane of incidence. Moreover, a light-emitting part is plurality, and each light-emitting part has aligned so that it may be arranged on the near side face which each cylindrical light source leaves mutually.

[0008] In each light-emitting part, the cylindrical light source inclines seen from the luminous-radiation side of a light guide plate in the direction where the side face where it has been arranged [in] on the background and the light guide plate countered is the same respectively. For this reason, the side face of a light guide plate

can be stuck with the side face of other light guide plates. Thereby, the luminous-radiation side of each light guide plate can be connected.

[0009]

[Embodiment of the Invention] Hereafter, the gestalt of 1 operation of this invention is explained to a detail using a drawing. Drawing 1 is the block diagram of the light-emitting part which constitutes the luminescence panel equipment by this invention, and drawing 1 (A) is a sectional view in which an important section perspective view and drawing 1 (B) show perspective drawing, and drawing 1 (C) shows the 1C-1C' line cross section of drawing 1 (B).

[0010] In drawing 1 , a light guide plate 11 makes the light introduced from optical plane-of-incidence 11a penetrate, and is emitted from luminous-radiation side 11b. As shown in drawing 1 (B), this light guide plate 11 is carrying out the shape of a rectangle as a whole. Moreover, as shown in drawing 1 (C), optical plane-of-incidence 11a of a light guide plate 11 and luminous-radiation side 11b counter, and are arranged. The side face of a NI pair in which a light guide plate 11 counters is formed in parallel, respectively. However, as shown in drawing 1 (C), 11d inclines in side-face 11c of a pair, and the same direction. Optical plane-of-incidence 11a is arranged along the field where optical plane-of-incidence 11a is arranged, and the base of side-face 11c which makes an acute angle.

[0011] This light guide plate 11 is formed of the member which has the translucency of for example, acrylic resin etc. Moreover, diffusion dot printing is performed to luminous-radiation side 11b of a light guide plate 11, and minute irregularity is formed on luminous-radiation side 11b. When the field more distant from optical plane-of-incidence 11a forms much irregularity, the light emitted from luminous-radiation side 11b can be equalized.

[0012] Moreover, along with optical plane-of-incidence 11a of a light guide plate 11, the fluorescence tubing 12 as the cylindrical light source is arranged. Since the polar zone of the both ends of this fluorescence tubing 12 does not emit light, the fluorescence tubing 12 is arranged so that the nonluminescent field containing the polar zone may project from optical plane-of-incidence 11a. Thus, it can prevent the umbra which originates in luminous-radiation side 11b of a light guide plate 11 to the nonluminescent field of the fluorescence tubing 12 arising by making only the luminescence field of the fluorescence tubing 12 approach optical plane-of-incidence 11a of a light guide plate 11.

[0013] This fluorescence tubing 12 is covered by the lamp reflector 13 except for the optical plane-of-incidence 11a side of a light guide plate 11. Moreover, the edge of the lamp reflector 13 is pasted up on the periphery of optical plane-of-incidence 11a of a light guide plate 11. This lamp reflector 13 reflects in optical plane-of-incidence 11a the light which did not carry out direct incidence to optical plane-of-incidence 11a of a light guide plate 11 among the light emitted from the fluorescence tubing 12.

[0014] Adhesion arrangement of the 1st light reflex plate 14 is carried out at side-face 11c by the side of the fluorescence tubing 12 of a light guide plate 11. This light reflex plate 14 is for reflecting the light introduced from optical plane-of-incidence 11a of a light guide plate 11, and making the interior of a light guide plate 11 carry out a light guide. If the angle of luminous-radiation side 11a of a light guide plate 11 and the light reflex plate 14 to make is 45 degrees, the interior of a light guide plate 11 can be made to carry out the light guide of the synchrotron orbital radiation of the fluorescence tubing 12 most efficiently.

[0015] Moreover, adhesion arrangement of the 3rd light reflex plate 15 is carried out at the fluorescence tubing 12 of the field where optical plane-of-incidence 11a of a light guide plate 11 is arranged, and the part (namely, part by which optical plane-of-incidence 11a is not arranged) which does not counter. Moreover, adhesion arrangement of the 2nd light reflex plate 16 is carried out at 11d of near side faces distant from the fluorescence tubing 12 of a light guide plate 11. The light reflex plates 15 and 16 reflect in luminous-radiation side 11b the light which was not emitted from luminous-radiation side 11b of a light guide plate 11 among the light which penetrates a light guide plate 11. That by which the silver vacuum evaporationo film was formed in the inside side of polyester film is used for the lamp reflector 13 and the light reflex plates 14-16.

[0016] Furthermore, adhesion arrangement of the optical diffusion sheet 17 is carried out at luminous-radiation side 11b of a light guide plate 11. This optical diffusion sheet 17 is formed for example, with poly KABONETO resin, and minute irregularity is formed in the front face of diffusion dot printing. Moreover, the lighting sections 18, such as an inverter, are arranged in the tooth-back side of the light reflex plate 15. This lighting section 18 is connected to the polar zone of the both ends of the fluorescence tubing 12 as shown in drawing 1 (B).

[0017] Next, actuation of the light-emitting part 10 shown in drawing 1 is explained. As for the light emitted from the fluorescence tubing 12, direct incidence of the part is carried out to optical plane-of-incidence 11a of a light guide plate 11, scattered reflection of the remainder is carried out by the lamp reflector 13, and incidence is carried out to optical plane-of-incidence 11a of a light guide plate 11. Scattered reflection of the light introduced from optical plane-of-incidence 11a is carried out with the light reflex plate 14, it penetrates the interior of a light guide plate 11, and is emitted from luminous-radiation side 11b. Or scattered reflection is further carried out with the light reflex plates 15 and 16, and it is emitted from luminous-radiation side 11b. Optical diffusion is carried out by the optical diffusion function of the optical diffusion plate 17 in the direction of a front face, and the light introduced into the optical diffusion plate 17 from luminous-radiation side 11b of a light guide plate 11 is emitted in the direction shown in drawing 1 (C) by the arrow head 30 as a light uniform in the direction of a field.

[0018] In addition, in a light-emitting part 10, even if it uses the fluorescence tubing 12 of the same quantity of light, required brightness can be obtained by adjusting the size of a light guide plate 11.

[0019] Drawing 2 is a block diagram when alignment arrangement of two or more light-emitting parts 10 is carried out, and it is the sectional view in which drawing 2 (A) shows a top view, and drawing 2 (B) shows the important section of the 2B-2B' line cross section of drawing 2 (A). As mentioned above, the light guide plate 11 shown in drawing 1 side-face 11c Reaches, and 11d is formed in parallel. Therefore, the light reflex plates 14 and 16 arranged on each side faces 11c and 11d are also parallel. For this reason, when aligning two or more light-emitting parts 10 in the shorter direction (direction perpendicular to the longer direction of the fluorescence tubing 12) of a light-emitting part 10, as shown in drawing 2 (B), the light reflex plates 14 and 16 of each light-emitting part 10 can be stuck with the light reflex plates 16 and 14 of other light-emitting parts 10, respectively.

[0020] Moreover, each light-emitting part 10 can be arranged so that the luminescence side of each light-emitting part 10 may continue a light-emitting part 10, since each light-emitting part 10 can be stuck also in the longer direction (direction parallel to the longer direction of the fluorescence tubing 12). And a uniform light is emitted from each light-emitting part 10. Therefore, by arranging each light-emitting part 10 so that the luminescence side of each light-emitting part 10 may continue, it can be large and, moreover, uniform field luminescence can be obtained.

[0021] By the way, although light is emitted a little near the fluorescence tubing 12 strength in the luminescence side of a light-emitting part 10, since arrangement of the fluorescence tubing 12 is distributed by arranging the fluorescence tubing 12 to side-face 11c of the side which a light guide plate 11 leaves mutually as shown in drawing 2 (B), the brightness spots in a luminescence side can be controlled. Furthermore, when arranging a light-emitting part 10 in NI dimension, the brightness spots in a luminescence side can be similarly controlled by shifting and arranging each light-emitting part 10 so that the fluorescence tubing 12 may be arranged alternately, as shown in drawing 2 (A).

[0022] Although the optical diffusion sheet 17 is arranged on luminous-radiation side 11b of a light guide plate 11 as mentioned above, it is desirable to use the optical diffusion sheet 17 of the one-sheet thing which can straddle and can cover luminous-radiation side 11b of all the light-emitting parts 10 by which alignment arrangement is carried out for this optical diffusion sheet 17. By using such an optical diffusion sheet 17, bright luminescence can be obtained also by the knot of a light-emitting part 10 and a light-emitting part 10. In addition, as shown in drawing 1 , it is effective in installation becoming easy by doubling a light-emitting part 10 and the lighting section 18, and carrying out unitization of the luminescence panel equipment.

[0023] Drawing 3 is the perspective drawing of the light-emitting part 10 when other

fluorescence tubing is used as the cylindrical light source. Since the fluorescence tubing 12 used with the light-emitting part 10 shown in drawing 1 has a nonluminescent field to both ends, as mentioned above, the nonluminescent field of the fluorescence tubing 12 is projected and arranged from optical plane-of-incidence 11a of a light guiding pipe 11. For this reason, a light-emitting part 10 will contain the dead space equivalent to the nonluminescent field of the fluorescence tubing 12.

[0024] On the other hand, the nonluminescent field of both ends is bent by the one direction, and the fluorescence tubing 22 shown by the dotted line by drawing 3 (A) is formed in the KO typeface. This fluorescence tubing 22 is arranged so that only a luminescence field may approach optical plane-of-incidence 11a of a light guide plate 11. By using this fluorescence tubing 22, a nonluminescent field can be arranged at the tooth back of a light guide plate 11. Furthermore, if it arranges so that the nonluminescent field of the fluorescence tubing 22 may approach the light reflex plate 15, since the dead space resulting from the nonluminescent field of the fluorescence tubing 22 will not be produced, a light-emitting part 10 can be miniaturized.

[0025] Moreover, the nonluminescent field of one edge is bent by the one direction, and the fluorescence tubing 23 shown in drawing 3 (B) as a dotted line and a continuous line is formed in L typeface. The nonluminescent field of the other-end section where this fluorescence tubing 23 is not bent is projected and arranged from optical plane-of-incidence 11a of a light guide plate 11. If this fluorescence tubing 23 is used, only the dead space resulting from one nonluminescent field of the fluorescence tubing 23 is reducible.

[0026]

[Effect of the Invention] As explained above, since the side face where the cylindrical light source has been arranged [in] seen from the luminous-radiation side of a light guide plate on the background, and the light guide plate countered inclines in the same direction, by this invention, the luminescence side of each light-emitting part can be connected. For this reason, uniform large and field luminescence can be obtained by connecting two or more light-emitting parts which emit a uniform light.

[0027] Moreover, like, although light is emitted a little near the cylindrical light source strength, since arrangement of the cylindrical light source is distributed by arranging on the near side face according to claim 2 in which a light guide plate leaves each cylindrical light source mutually, the brightness spots in a luminescence side can be controlled. When arranging a light-emitting part in NI dimension, by [according to claim 3] arranging a light-emitting part so that each cylindrical light source may be alternately arranged like, arrangement of the cylindrical light source is distributed similarly and brightness spots can be controlled.

[0028] Moreover, since the interior of a light guide plate can be made to be able to carry out the light guide of the synchrotron orbital radiation of the cylindrical light source efficiently and it can emit from a luminous-radiation side by arranging the 1st

and 2nd reflecting plates like, respectively on the side face according to claim 4 on which the light guide plate countered, a uniform and bright luminescence side can be acquired. Moreover, loss of the light emitted from the cylindrical light source can be reduced by [according to claim 5] adjoining the optical plane of incidence of a light guide plate, and arranging the 3rd reflecting plate like. Moreover, loss of the synchrotron orbital radiation of the cylindrical light source can be similarly reduced by [according to claim 6] arranging a reflector like, as the cylindrical light source is covered.

[0029] Moreover, bright luminescence can be obtained also by the knot of a light-emitting part and a light-emitting part by [according to claim 7] arranging an optical diffusion sheet like, as the luminous-radiation side of two or more light guide plates is covered. Moreover, contiguity arrangement only of the luminescence field of the cylindrical light source is carried out at this optical plane of incidence by [according to claim 8] arranging the nonluminescent field of the cylindrical light source like, so that it may project from the optical plane of incidence of a light guide plate. Therefore, since the umbra based on the nonluminescent field of the cylindrical light source does not occur in the luminescence side of a light-emitting part, field luminescence without brightness spots is obtained.

[0030] Moreover, since the dead space which originates in a nonluminescent field by using the cylindrical light source according to claim 9 in which one [at least] nonluminescent field bent and was formed like can be deleted, luminescence panel equipment can be miniaturized. Moreover, luminescence panel equipment can be miniaturized by carrying out contiguity arrangement of the nonluminescent field according to claim 10 where the cylindrical light source was bent like at the 3rd light guide plate.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram of the light-emitting part which constitutes the luminescence panel equipment by this invention.

[Drawing 2] It is a block diagram when alignment arrangement of two or more light-emitting parts is carried out.

[Drawing 3] It is the perspective drawing of a light-emitting part when other fluorescence tubing is used.

[Drawing 4] It is the block diagram of conventional luminescence panel equipment.

[Description of Notations]

10 [-- A luminous-radiation side, 11c, 11d / -- A side face, 12, 22, 23 / --

Fluorescence tubing, 13 / -- A lamp reflector, 14-16 / -- A light reflex plate, 17 / -- An optical diffusion sheet, 18 / -- Lighting section.] -- A light-emitting part, 11 -- A light guide plate, 11a -- Optical plane of incidence, 11b